A BIOSYSTEMATIC REVISION OF *LUPINUS LYALLII*

B. J. Cox[1]

Systematics of the genus *Lupinus* is often viewed as one of the most perplexing studies ever attempted. This is attested by the diverse taxonomic treatments of various floras and special publications. While several students of the lupines have recognized many entities, others have found these plants in such confusing mosaics that enormous synonymic reductions were made; neither approach has solved the taxonomic problems formed by lupine diversity.

In a biosystematic revision of the *Lupinus lepidus*-*L. caespitosus* complex of the Sierra Nevada, Cascade and Rocky Mountains, various techniques of study were employed in an effort to show the degree of relationship between the taxa (Cox 1972a). Over 75 epithets have been applied to various members of this complex since 1828 when *L. lepidus* was described, and these epithets have been considered by some as referable to a single species.

In order to present the concept of the *L. lepidus*-*L. caespitosus* complex in a digestible and economically feasible form, a taxonomic treatment of only *Lupinus lyallii*, its five subspecies and six varieties will be offered here. More complete distribution maps, cytological and chemotaxonomic data, photographs of typical specimens, and illustrations of typical leaflet and floral parts are given elsewhere (Cox 1972a, 1972b, 1973a, 1973b).

Chromosome numbers: Taxa within *Lupinus lyallii* have chromosome number reports of $2n = 48$ (subsp. *lyallii*, var. *lyallii* and var. *villosus*, and subsp. *minutifolius*) by Cox (1972b). The chromosomes are extremely small and counts are difficult to obtain, undoubtedly explaining the lack of previous reports. Although Phillips (1957) reported a chromosome count for *L. lyallii* of $n = 24$, his study plant was *L. minimus*. Chromosome counts have offered little in determining the genetic affinities within the *L. lepidus-L. caespitosus* complex since all reported numbers are $2n = 48$ (Cox 1972b).

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[1] Studies conducted at the Division of Biological Sciences, University of Missouri, Columbia, Missouri.

Chemosystematic data. Seed proteins: Comparisons were made of seed proteins of four of the *L. lyallii* taxa by polyacrylamide gel electrophoresis (Cox 1972a, 1973b). Considerable variation was found in several polymorphic populations; largely, the electrophoresis disc protein data closely resemble those data from the morphological study in the degree of variation found. Although no protein band occurred in common with all taxa studied, likewise no protein band was found unique to any one taxon. Each population was found to have a distinct combination of proteins, resulting in low percent similarity values between the taxa.

Seed Alkaloids: The seed alkaloids of all of the subspecies and varieties of *Lupinus lyallii* were compared by thin-layer chromatography (TLC) separation by Cox (1973a). Although some interpopulational variation was found, the alkaloids were generally quite consistent. Correlations were made between alkaloid shapes, R_f values, positive color reactions with two different visualizing agents, and comparisons with standards. Percent similarity values were high among the interspecific taxa, and identical alkaloid combinations were shared among a few, these differing only in relative amounts of individual alkaloids.

Morphological and distributional considerations: Field and herbarium-laboratory studies were conducted over a three year period on the *Lupinus lepidus-L. caespitosus* complex. Techniques and preparations of specimens for measurements in the descriptions are given by Cox (1972a).

The following herbaria are acknowledged for the use of over 1000 specimens of the taxa of *Lupinus lyallii:* AEC, ARIZ, BRY, CAN, DS, GH, ISC, JEPS, MIN, MO, NMC, NY, POM, ORE, OSC, RENO, RM, RSA, SMU, UBC, UC, UMO, US, UTC, V, WILLU, WS.

Lupinus lyallii A. Gray

Plants perennial, herbaceous, caespitose or mat-like, less than 18 cm. tall; leaflets few (5-9), oblanceolate, the largest less than 2 cm. long; banners glabrous, usually reflexed below the midpoint.

Distribution: The taxa are primarily found in the high Sierra Nevada and Cascade Mountains with a few populations radiating out into isolated localities (Fig. 1).

KEY TO THE SUBSPECIES AND VARIETIES OF LUPINUS LYALLII

A. Plants with spreading villous-hirsute to shaggy pubescence. . . . . B.
  B. Plants less than 10 cm. tall; flowers 6-7 mm. long; largest leaflets 4-6 mm. long; Sierra Nevada, alpine, dwarf. . . . . . . 1b. *L. lyallii* subsp. *lyallii* var. *danaus*.
  B. Plants usually taller; flowers over 7 mm. long; largest leaflets over 6 mm. long. . . . . C.
    C. Plants decumbent, mat-like; leaflets 6-7, largest 10-13 mm. long; Sierra Nevada, with a few stations in Klamath Co., Ore. . . . . 1f. *L. lyallii* subsp. *lyallii* var. *villosus*.
    C. Plants erect to semi-decumbent, branching, 10-18 cm. tall; leaflets 5-6, largest 9-21 mm. long; Washoe Co., Nevada. 5. *L. lyallii* subsp. *washoensis*.
A. Plants with appressed to subappressed pubescence. . . D.
  D. Plants erect in densely branching clumps; 12-18 cm. tall; Rogue River-Crater Lake region, Oregon. . . E.
    E. Branching stems mostly woody, less than 1.5 mm. in diameter; leaflets 5-6; racemes 1.3-1.4 cm. in diameter; flowers 6-7.5 mm. long. . . . . . . 1c. *L. lyallii* subsp. *lyallii* var. *fructiculosus*.
    E. Branching stems mostly herbaceous, more robust; leaflets 7-9; racemes 1.9-2.5 cm. in diameter; flowers 7-9.5 mm. long. . . . . 1e. *L. lyallii* subsp. *lyallii* var. *roguensis*.
  D. Plants decumbent or erect and densely caespitose. . . . . F.

F. Plants mat-like, usually less than 10 cm. tall; flowers 6-7 mm. long; largest leaflets 4-6 mm. long; alpine, Sierra Nevada Range. .... 1b. *L. lyallii* subsp. *lyallii* var. *danaus.*

F. Plants usually larger or flowers longer. ..... G.

G. Plants 4-6 cm. tall; flowers 7.5-10 mm. long; largest leaflets 6-9 mm. long, upper surface glabrous; Steens Mts, Harney Co., Oregon. .... 3. *L. lyallii* subsp. *minutifolius.*

G. Plants mostly taller; flowers various; largest leaflets various lengths, mostly pubescent (becoming somewhat glabrate in subsp. *alcis-temporis*). .... H.

H. Plants mostly decumbent; Clearwater Co., Idaho. . . 2. *L. lyallii* subsp. *alcis-temporis.*

H. Plants erect or mat-like, not decumbent. .... I.

I. Leaves all basal, erect, in small tufts; petioles 3-9 cm. long; largest leaflets 9-22 mm. long; SW Idaho & NE Nevada. . . 4. *L. lyallii* subsp. *subpandens.*

I. Leaves cauline, basal, or both, generally ascending or more or less spreading, generally not in small tufts; petioles usually 2-5.5 cm. long; largest leaflets 5-12 mm. long. .... J.

J. Flowers 10-12.5 mm. long; racemes 2.5-4.5 (5.5) cm. long, 2.5-3.0 cm. in diameter; leaflets 6-9; high alpine areas of western Cascade Range, Ore. & Wash. .... 1d. *L. lyallii* subsp. *lyallii* var. *macroflorus.*

J. Flowers 7.5-10.5 mm. long; racemes 1.5-3 cm. long, 2.0-2.3 cm. in diameter; leaflets 5-7; alpine and subalpine, wide distribution, Sierra Nevada Range, Calif. & Cascade Range,

Ore., Wash. & B. C. . . . . 1a.
L. lyallii subsp. *lyallii* var. *lyallii.*

1a. **Lupinus lyallii** subsp. **lyallii** var. **lyallii**

Lupinus lyallii A. Gray, Proc. Amer. Acad. **7**: 334. 1868. Type: "Summit of the Cascade Mountains, lat 49°, elev. 7500 ft.", *Lyall,* Jul 1860 (Holotype: K; Isotypes: BM, GH, POM). Photos: (RSA, UC, UMO, US).

L. lepidus subsp. *lyallii* (Gray) Detl., Amer. Mid. Nat. **45**: 490-491. 1951.

L. alpinus Heller, Muhlenbergia **6**: 22. 1910. Type: NEVADA: WASHOE CO.: Mt Rose, *Heller* 9914a (Holotype: Nev. Agr.; Isotypes: GH, ISC, MIN, NMC, NY, POM, RSA, UC, US, WS). Photos: (RSA, UMO).

L. paulinus Greene, Leafl. Bot. Obs. & Crit. **2**: 234. 1912. Type: OREGON: DESCHUTES CO.: Paulina Lake, W end, *Leiberg* 550 (Holotype: US; Isotypes: GH, UC).

L. rubro-soli Eastw., Leafl. West. Bot. **3**: 203. 1941. Type: CALIFORNIA: MENDOCINO CO.: Red Mt., *Eastwood & Howell* 4674 (Holotype: CAS; Isotype: US). Photos: (RSA, UMO).

Plants perennial, caespitose, forming mat-like radicle clumps, 15-25 cm. in diameter, from a thick, woody caudex which often branches in older plants, 6-17 cm. tall; foliage 2-7 cm. tall; stems poorly developed, less than 1.5 mm. in diameter, semi-prostrate, some sprawling-decumbent, some erect, subappressed silky sericeous throughout, hairs usually less than 1 mm. long; cauline nodes 0-2; petioles slender, 2-5(7.5) cm. long; stipules generally inconspicuous; leaflets 5-7, oblanceolate-linear to elliptic-obovate, apex acute to short mucronate, largest 5-12(18) mm. long, av. 9.95 mm., 1.5-4.5 mm. wide, length to width ratio 2.17-4.0(6.0), av. 3.18, appressed silky-sericeous on both surfaces; peduncles usually much exceeding the foliage, 3-8(10) cm. long; racemes capitate to subcapitate, 1.5-3 cm. long, occasionally to 4.0 cm. at anthesis, 20-23 mm. in diameter, rarely 2× as long as wide; flowers dense, blue, 7.5-10.5 mm. long, av. 9.44; bracts persistent to caducous, 3-6.5 mm. long, subulate to lance-linear; pedicels 1.5-2.5 mm. long; calyx bilabiate, the upper-lip 3.5-6.0 mm. long, bilobed, the notch 1-2.5 mm. deep, the lower-lip 3.8-6.8 mm. long, apex serrate to tridentate, the center tooth to 0.5 mm. long, lips connate 1-2 mm., bracteoles usually present but inconspicuous, to 0.5 mm. long, attached at the sinus, sericeous; banner elliptic-oblong to suborbicular, glabrous, 7-10 mm. long, 5.1-8.0 mm. wide, length to width ratio 1.10-1.57, av. 1.29, reflexed below or near the midpoint, the reflexed to appressed ratio 1-1.3, av. 1.14, angle 120-150°; wings 6.5-9.8 mm. long, 3.5-5.5 mm. wide, length to width ratio 1.56-2.25 av. 1.90, claws 1.0-2.2 mm. long, glabrous; keel 2.5-3.0 mm. wide at the widest point, angle 105-111°, ciliated along the upper margin near the acumen; ovules 3-5; pods 10-15 mm. long, 4-5 mm. wide, short sericeous; seeds 2-4, 1.8-3.0 mm. × 2.6-3.5 mm., 1-1.5 mm. thick, tan, beige, brown and green mottled.

This variety is primarily alpine to subalpine, ranging latitudinally in its distribution from the high Sierra Nevada Mountains of California through the Cascade Range of Oregon and Washington into British Columbia. These plants may be found in several soil types, such as volcanic ash, disintegrated granite, sandy, gravelly rock of several compositions to shale. They usually occur on slopes associated most frequently with *Pinus contorta, P. murrayana, P. albicaulis* and *Tsuga mertensiana.* Altitudinally, the plants are found above timberline at 3660 m. down to about 2439 m., or in the more northerly latitudes to about 1830 m. Flowering occurs between June and September; the plants flowering during the latter part of the season usually are found in sites of lingering snowbanks.

Representative specimens: CANADA: **British Columbia:** Bomford Mt, Ashnola Dist, *Barr* 9351 (UBC); Chilcotin, *Copley* 472 (V); Lillooet, *Anderson,* Jul 1916 (V); Manning Park, *Hardy,* Aug 1945 (V); Mt McLean, *Anderson* 7987 (V); Mt Moor, *Bird* 3436 (UBC); Nicoamen River head, *Dawson* 5133 (CAN); Noaxe Lake, *Brink,* Aug 1957 (UBC); Yalakom River, *Sugden* 118 (V). USA: **California:** ALPINE CO.: Carson Pass, *Yates* 3980 (UC). EL DORADO CO.: Desolation Valley, *Abrams* 12740 (GH, NY, POM, UC). FRESNO CO.: Humphreys

Basin, headwaters Piute Creek, *Quibell* 5113 (UC). LASSEN CO.: Lassen Volcanic Natl. Park, *Rickett*, Aug 1968 (UMO). MADERA CO.: Mt Lyell, at Moraine Meadows, *Akey* 318 (UC). MARIPOSA CO.: Mt Connes, Tioga Pass, *Ramsey & Ramsey* 2496 (POM). MODOC CO.: Antelope Valley, *Applegate* 847 (US). MONO CO.: Bodie, 2.2 mi N-NW, *Graham* 274 (UC). NEVADA CO.: Mt Stanford, *Sonne* 54 (MO). PLACER CO.: Snow Mt, *Bolt* 103 (UC). SHASTA CO.: Bolam Road, near the S.P. RR, *Cooke* 15003 (UC). SISKIYOU CO.: Bolam Creek Canyon, opposite Coquette Falls, Mt Shasta, *Cooke* 25691 (UC). TEHAMA CO.: King Creek Meadow, Lassen Volcanic Natl. Park, *Heller* 15426 (MO, NY). TRINITY CO.: Fisher Ridge, E of Black Rock, North Yolla Bolly Mts, *Munz* 16743 (RSA). TULARE CO.: Golden Trout Creek, *Hall & Hall* 8417 (UC). TUOLUMNE CO.: Bond Pass, *Winkelman* 276 (UC). **Nevada:** WASHOE CO.: Mt Rose, *Kennedy* 1148 (NY, UC, US). **Oregon:** CURRY CO.: Bear Camp Ranger Station, *Leach* 1692 (ORE). DESCHUTES CO.: Bend, *Farnham & Beach* 97 (OSC). DOUGLAS CO.: Bailey Mt, *Applegate* 4121 (UC). JACKSON CO.: Ashland Peak, *Thompson* 12383 (MO, NY, UC) JEFFERSON CO.: Hoodoo, Big Lake Turnoff, US Hwy 20, *Isely & Isely* 11299 (ISC, UMO). JOSEPHINE CO.: Free and Easy Trail, head of Babyfoot, *Leach* 2661 (ORE). KLAMATH CO.: btn Fort Klamath & Summit, *Furlong et al*, 1901 (UC). CRATER LAKE NATL. PARK: Summit Lake, *Henderson* 9634 (WS). LAKE CO.: Drews Valley, *Austin* 1649 (US). LANE CO.: McKinzie Pass, *Peck* 5467 (WILLU). LINN CO.: Big Lake, *Hawley & Anderson*, Jul 1927 (OSC). WALLOWA CO.: Wallowa Mts, Aneroid, 2 mi S, *Peck* 17985 (UC). **Washington:** CHELAN CO.: Blewett Pass region, *Grant*, Aug 1929 (UC). CLALLAM CO : Hurricane Ridge, *Thompson* 14226 (GH, NY, US). JEFFERSON CO.: Iron Mt, *Thompson* 11049 (MO, NY, POM, US). OKANOGAN CO.: Bunker Hill summit, *Edwards* 32 (WS). PIERCE CO.: Mt Rainier Natl. Park: Flett's Glacier, *Flett* 3124 (WS). WHATCOM CO.: Mt Baker, Heliotrope Ridge, *Muenscher* 8201 (GH, UC, US, WS). YAKIMA CO.: Hell Roaring Canyon rim, *Langdon* 116 (OSC).

The populations from the Wallowa Mountains (Wallowa Co., Oregon) are isolated from other *Lupinus lyallii* subsp. *lyallii* populations by 322 km.; the subsp. *alcis-temporis* occupies areas along the Clearwater and Selway Rivers in Idaho, but it is quite distinctive. The growth habit of the Wallowa populations appears to be typically that of var. *lyallii* specimens in the normal distribution, with short vegetation to 7 cm. tall, capitate inflorescences 2-2.5 cm. long, small flowers 6-8 mm. long and short leaves 7-10 mm. long. But, these plants hold in common with *L. minimus* a strong woody branching caudex at above ground level, many stems in a clump with leaves appearing basal, not more than 2-3 cauline leaves, and silky pubescence.

The specimens of *Lupinus lyallii* subsp. *lyallii* var. *lyallii* in Deschutes Co., Oregon (*Leiberg* 550 — GH, UC, US), described as *L. paulinus* by Greene, are somewhat larger than other *L. lyallii* plants of the immediate region but closely resemble several populations found in California. The racemes of some plants range from 3-4 cm. to 7.5 cm. long and from 16 mm. to 22 mm. in diameter, with the leaflets 11-15 mm. long, the upper surface of the leaflets sparsely pubescent, flowers approaching 9 mm. long and peduncles 6-7 cm. long. Several plants resemble *L. sellulus* var. *lobbii* with the flowers scattered in verticils somewhat like *L. sellulus* var. *medius* (Cox 1973c). However, the population sample indicates that these variants are more closely related to *L. lyallii* subsp. *lyallii* var. *lyallii* than to any other taxon and not distinctive enough to warrant a separate epithet.

The material found on Mt. Rose in Nevada, which Heller called *Lupinus alpinus*, flowers from late July to late September and occurs at elevations of 2927-3110 m.

The plant habit is low and spreading mats, much like that on Mt. Rainier in Washington. Colonies occur in grassy open meadows, in the alpine belt. Although the plants may be somewhat atypical of the California *L. lyallii* subsp. *lyallii* var. *lyallii* specimens, they are much like those of Oregon and Washington.

1b. **Lupinus lyallii** subsp. **lyallii** var. **danaus** (A. Gray) S. Wats., Proc. Amer. Acad. 8: 534. 1873.

L. danaus Gray, Proc. Amer. Acad. Arts & Sci. 7: 335. 1868. Type: CALIFORNIA: TUOLUMNE CO.: Mt Dana, *Bolander* 5087 (Holotype: GH; Isotype: UC, US).

L. danaus var. *bicolor* Eastw., Leafl. West. Bot. 2: 201. 1939. Holotype: CALIFORNIA: TUOLUMNE CO.: Mt Dana, *Howell* 14539 (CAS). Photos: (RSA, UMO).

L. oreocharis Eastw., Leafl. West. Bot. 3: 171. 1942.

Holotype: CALIFORNIA: TULARE CO.: Little Five Lakes Basin, *Howell* 17392 (CAS). Photos: (RSA, UMO).

Plants differing from *L. lyallii* subsp. *lyallii* var. *lyallii* by matted vegetative growth, 1-4 cm. tall; plant overall height usually less than 10 cm. tall; pubescence frequently sparse, spreading; largest leaflets mostly 4-6 mm. long, rarely to 10 mm. long; peduncles 1.5-3 cm. long, rarely to 8 cm. long; racemes capitate, 1.5-2.0 cm. long; flowers frequently more loosely arranged than in var. *lyallii*, smaller, 6-7 mm. long.

Representative specimens: **California:** FRESNO CO.: Humphreys Basin, headwaters Piute Creek, W of Mt Humphreys, *Sharsmith* 3136 (UC). INYO CO.: Piute Pass, E slope, *Peirson* 2552 (RSA). MADERA CO.: Isberg Pk, 1 mi SW, *Akey* 332 (UC). MARIPOSA CO.: Mt Dana, *Congdon*, Aug 1898 (UC). MODOC CO.: Mt Warren, *Payne* 307 (JEPS). MONO CO.: San Juaquin Peak, *Wright* K3 (POM). TULARE CO.: Mt Whitney, *Clemens*, Jul 1910 (POM, UMO). TUOLUMNE CO.: Gaylor Lakes, *Howell* 20401 (WS).

The depauperate forms of *L. lyallii* subsp. *lyallii* are interpreted here as being ecological variants. Under a particular set of environmental conditions populations of *L. lyallii* dwarfs to the matted form of var. *danaus*. However, frequently within the same population typical var. *lyallii* may occur in the larger form. Both varieties are found in high alpine rocky, sunny areas. Although this depauperate or ecological variant of *L. lyallii* appears to be morphologically blending with the larger variety, it is considered here as a distinct taxon at the varietal level.

A variant of similar vegetative morphology was observed among the *Lupinus lyallii* specimens of Canada and the higher alpine areas of Washington and Oregon, but the reproductive structures differ from that of var. *danaus* in California.

Lupinus oreocharis is reduced to synonymy under var. *danaus*. Although some of these plants range to 14 cm. tall and resemble var. *villosus* in pubescence, and some may differ from var. *danaus* by having slightly elongated stems which may have 1-2 cauline leaves, the available evidence does not indicate the warrant of a special epithet.

1c. **Lupinus lyallii** subsp. **lyallii** var. **fruticulosus** (Greene) C. P. Sm., Bull. Torrey Bot. Club **51:** 303. 1924.

L. fruticulosus Greene, Muhlenbergia 8: 117. 1912. Type: OREGON: KLAMATH CO.: Anna Creek Valley, *Austin* 1650 (Holotype: US; Isotypes: NY, POM). Photos: (RSA, UMO, US).

L. perditorum Greene, Muhlenbergia 8: 117. 1912. Holotype: OREGON: JACKSON CO.: Upper Rogue River, Applegate 2636 (US). Photo: (US).

Plants in dense semi-shrubby clumps, branching profusely, erect to semi-decumbent; stems 12-17 cm. tall, usually less than 1.5 mm. in diameter; leaves cauline; petioles slender, 2-5 cm. long; leaflets 5-6, elliptic-oblanceolate, largest 5-12 mm. long, av. 8.4, 1.8-3.5 mm. wide, length to width ratio 2.78-4.0, av. 3.42, subappressed, strigose-pilose on both surfaces; peduncles 2.5-5.5 cm. long; racemes numerous, 1.5-4.3 cm. long, 13-14 mm. in diameter, capitate and dense to somewhat scattered; flowers blue, 6.0-7.5 (8.0) mm. long, av. 6.9 mm.; bracts 1.5-3.0 mm. long; pedicels 0.5-1.5 mm. long; banner elliptic to suborbicular, reflexed below the midpoint; pods 7.5-10 mm. long, 3.3-4 mm. wide; seeds 2-3.

The greatest development of var. *fruticulosus* is along the flood plain of the Rogue River in Klamath Co., Oregon. Plants are found at elevations of 1067-1372 m., flowering in July.

Representative specimens: **Oregon:** JACKSON CO.: Ashland, 9.7 km S, *Sherwood* 842 (WILLU). KLAMATH CO.: Crater Lake Natl. Park, *Evinger* 608 (OSC). LINN CO.: Hunt's Cove, Mt Jefferson area, *Leach* 4485 (ORE).

Variety *fruticulosus* differs morphologically from other variants of *Lupinus lyallii* by its semi-shrubby base, profusely branching clump habit and smaller flowers. A few *L. lyallii* specimens from Washington (mainly var. *macro-*

florus) have thick, woody branching bases, but these are part of the underground caudex system and differ by having distinctively larger inflorescence structures. The Washington material is more robust than *fruticulosus*. Variety *fruticulosus* is one of the most distinctive variations of *L. lyallii* subsp. *lyallii*.

Variety *fruticulosus* is morphologically similar to var. *roguensis*, of the same general geographical region, and to subsp. *alcis-temporis* of the Clearwater and Selway Rivers in Idaho. It may be separated from these two taxa on the basis of its flower morphology, more scattered flower arrangement on the racemes and smaller size, as well as differences in vegetative traits. These plants exhibit a more erect woody branching habit with more filiform petioles and stems than any closely related entities. They are generally not as leafy, and the leaflets are fewer (5-6 per leaf), smaller, and arranged in the upper portion of the branching clump.

1d. **Lupinus lyallii** subsp. **lyallii** var. **macroflorus** B. J. Cox, var. nov. Type: WASHINGTON: PIERCE CO.: Mt Rainier, Yakima Park, *Thompson* 11086 (Holotype: MO; Isotypes: NY, POM-in part, US). Photo of holotype: (Cox 1972 a).

Plantae perennes, humiles; caules ex caudice profuse ramificanti lignoso, 5-17 cm. alti, 1-15 mm. diametro, nodis 0-2(8); petioli 3-5.5 cm. longi; foliola 6-9, oblanceolata, maxima 5.5-11.3 mm. longa, 2.5-5.0 mm. lata; pedunculi 3.0-5.5 cm. longi, supra folia 1-2 cm. extensi; racemi 2.5-5.5 cm. longi, 2.5-3.0 cm. diametro, capitati usque subcapitati, floribus 5-17 in 1-5 verticillis; flores caerulei 10-12.5 mm. longi; calyx gibbosus; vexillum suborbiculatum usque obovatum; ovula 3-5; legumina 13-15 mm. longa, 4-5.5 mm. lata.

Plants perennial, in dense low mats; stems from a profusely branching woody base, 5-17 cm. tall, 1-1.5 mm. in diameter, pubescence appressed to ascending, some spreading, cauline nodes 0-2(8); petioles 3-5.5 cm. long; leaflets 6-9, oblanceolate, largest 5.5-11.3 mm. long, av. 8.29 mm., 2.5-5.0 mm. wide, av. 2.56 mm.; peduncles 3.0-5.5 cm. long, exceeding the foliage by 1-2 cm. or more; racemes 2.5-5.5 cm. long, 2.5-3.0 cm. in diameter, capitate to subcapitate, flowers 5-17 in 1-5 verticils; flowers blue, 10-12.5 mm. long, av. 11.2 mm. long; calyx gibbous at the base; banner suborbiculate to obovate, glabrous; keel densely ciliated near the acumen to glabrous in some; ovules 3-5; legumes 13-15 mm. long, 4-5.5 mm. wide.

Populations of var. *macroflorus* are found on the western side of the Cascade Mountain Range on both sides of the Columbia River in Washington and Oregon. They are found on Mary's Peak in Benton Co., on Mt. Hood of Clackamus and Hood River Counties, Santiam Pass in Linn Co., Oregon, and Mt. St. Hellens of Skamania Co., and Mt. Rainier of Pierce Co., Washington. Like var. *lyallii*, var. *macroflorus* occurs at the upper vegetational limit between timberline and snowline at elevations of 1524-2378 m. Plant communities commonly associated include the species: *Pinus contorta, P. albicaulis, Abies lasiocarpa, Tsuga mertensiana* and less frequently *Pseudotsuga menziesii*.

Representative specimens: **Oregon:** BENTON CO.: Corvallis, W at Mary's Peak, *Gilbert* 108 (OSC, US). CLACKAMUS CO.: Mt Hood, Jct of Hwys 26 & 35, *Downey* 4B (UMO, UTC). HOOD RIVER CO.: Mt Hood, *Abrams* 9445 (MO, POM, RM, WILLU). LINN CO.: Santiam Pass, *Cronquist* 7853 (GH, NY, RSA, UC, WS). **Washington:** PIERCE CO.: Mt Rainier Natl. Park, Burrough's Mt & Frozen Lake, *Flett* 3121 (WS). SKAMANIA CO.: Mt St Hellens, *Buzzettii*, Aug 1848 (OSC).

Variety *macroflorus* is distinct primarily on the basis of its larger flower size (10-12.5 mm. long) from var. *lyallii* flower size (7.5-10.5 mm. long). There are several intermediates between the variations of *L. lyallii*, but in general var. *macroflorus* is the extreme in flower morphological deviation.

1e. **Lupinus lyallii** subsp. **lyallii** var. **roguensis** B. J. Cox, var. nov. Type: OREGON: JACKSON CO.: Farewell Bend Forest Camp, 1.6 km N of Union Cr, on Rogue River flood plain, *Hitchcock* & *Martin* 4997 (Holotype: RSA; Isotypes: MO, NY, UC, WS). Photo of isotype: (Cox 1972a).

Plantae perennes, herbaceae, caespites densos ramificantes formantes, 2.5-3.5 dm. diametro, 12-18 cm. altae; caules humifusi usque erecti, 1-3 mm. diametro, ex caudice dense ramificanti lignoso, nodis 6-10, ad nodos ramificantes; foliola 7-9, maxima 8-13 mm. longa, 2.5-3.0 mm. lata; racemi capitati usque subcapitati 1.5-3.5 mm. longi, 4.5 mm. longi fructiferi, 1.9-2.5 mm. diametro; flores 7-9.5 mm. longi; vexillum et alae glabrae.

Plants perennial, herbaceous, in dense branching clumps, 2.5-3.5 dm. in diameter, 12-18 cm. tall; stems procumbent to erect, 1-3 mm. in diameter, from densely branching woody base, nodes 6-10, branching at the nodes; leaflets 7-9, largest 8-13 mm. long, 2.5-3.0 mm. wide; racemes capitate to subcapitate, 1.5-3.5 mm. long, 4.5 mm. long in fruit, 1.9-2.5 mm. in diameter; flowers 7-9.5 mm. long; banner and wings glabrous; keel ciliated along the upper margin near the acumen.

Variety *roguensis* is found at Diamond Lake, Huckleberry Mt., Davis Lake, and on the flood plain of the Rogue River, in Jackson and Klamath Counties, Oregon. These plants occur in sandy soil in pine forests at elevations of 915-1067 m. Flowering is from mid-June to mid-July.

Representative specimens: **Oregon:** JACKSON CO.: Huckleberry Mt, Rogue River Natl. Forest, *Thompson* 13035 (MO, RSA, UC, WILLU, WS). KLAMATH CO.: Davis Lake, W shore, *Hitchcock & Martin* 4935 (RSA).

Morphologically, these plants are most closely related to var. *fructiculosus*, but they differ in several significant characteristics. They are more robust, have larger branching procumbent to erect stems, have larger flowers that are more densely arranged in racemes, and have more leafy foliage. The leaves are more numerous and are scattered throughout the clump, and the leaflets are larger with more leaflets per leaf. The manner of branching resembles that of *L. aridus*, especially subspecies *lenorensis* (Cox 1972a) found along the Clearwater and Selway Rivers in Idaho. Although the general branching pattern is often difficult to detect, careful scrutiny finds verticillate spreading branching from an erect shoot; these branches become somewhat decumbent, but secondary and tertiary branches arise from them either adaxially or twisting around the decumbent stems and growing upward forming erect clumps.

Several color variations are found in this segment of *Lupinus lyallii.* Many plants of var. *roguensis* have albino flowers (white to cream color — *Maguire* & *Holmgren* 26493 — GH, NY, UC, US); however, others within the same population are intermediate in flower color to the albino and typical blue form (white to cream colored petals except for the purple banner and keel tip — *Maguire* & *Holmgren* 26494 — GH, MO, NY, UC, US, WS).

1f. **Lupinus lyallii** subsp. **lyallii** var. **villosus** Jeps., Jepson, Fl. Calif. 2: 267. 1936. Holotype: CALIFORNIA: ALPINE CO.: Carson Pass, *Jepson* 8100 (JEPS).

L. hypoleucus Greene, Leafl. Bot. Obs. & Crit. 1: 74. 1904. Type: CALIFORNIA: White Chief Peak, *Culbertson* 16, Jul 1904 (distributed by *Baker* 4416 — specimen not located.) Paratype: CALIFORNIA: Mt. Goddard, *Hall* & *Chandler* 707 (US).

Plants densely caespitose; stems decumbent to semi-erect, from a thick branching woody caudex, sericeous with ascending to long spreading white hairs turning reddish-brown with age; petioles 4-5 cm. long; leaflets 6-7, elliptic-oblanceolate, apex acute-mucronate, largest 10-13 mm. long, 3-5 mm. wide, villous on both surfaces; peduncles 3-7 cm. long; racemes densely verticillate 2.5-5 cm. long; bracts persistent, 4-6 mm. long; pedicels 1-1.5 mm. long; banner and wings glabrous; keel ciliate near the acumen; pods 10-11 mm. long, 4 mm. wide.

This variety occurs scattered throughout much of the distributional range of *L. lyallii* in several counties of California in the Sierra Nevada northward to several populations in Klamath Co., Oregon.

Representative specimens: **California:** ALPINE CO.: Carson Pass, *Higgins* 1752 (BRY). FRESNO CO.: Bubbs Creek, *Peirson* 531 (RSA). HUMBOLDT CO.: Grouse Mt, back of Clear Lake, *Tracy* 16672 (UC). LASSEN CO.: Grass Valley, *Fisher & Johnson* F203 (UC). MADERA CO.: Garnet Lake, *Howell* 16421 (RSA, UC, US). MARIPOSA CO.: Donohue Pass, *Schreiber* 1767 (UC). MENDOCINO CO.: South Yolla Bolly, *Jepson* 57t (JEPS). MONO CO.: San Juaquin Mt, *Howell* 16875 (WS). PLACER CO.: Mt Lincoln, *Howell* 18670 (US). SHASTA Yolla Bolly, *Jepson* 57t (JEPS). MONO CO.: San Juaquin Mt, *Howell* 16875 (WS). PLACIER CO.: Mt Lincoln, *Howell* 18670 (US). SHASTA CO.: Squaw Valley Creek Meadows, *Cooke* 13651 (NY). TRINITY CO.: Trinity Center, 3 mi S, E of Scott Ranch, *Cantelow*, Aug 1936 (RSA). TUOLUMNE CO.: Gaylor Lakes, *Howell* 20418 (GH). **Oregon:** KLAMATH CO.: Llao Rock, *Baker* 6245 (NY, OSC, UC, WS).

Variety *villosus* is recognized primarily on the basis of its dense pubescence. In *L. lyallii*, pubescence ranges from puberulent-sericeous to woolly-villous approaching spreading hirsute. Several populations exhibit different forms of pubescence within a single colony; this is especially true of those specimens viewed from the Carson Pass vicinity (the type locality of var. *villosus*), Alpine Co., California.

2. **Lupinus lyallii** subsp. **alcis-temporis** (C. P. Sm.) B. J. Cox, comb. nov.

Lupinus alcis-temporis C. P. Sm., Sp. Lup. 558. 1946. Type: IDAHO: CLEARWATER CO.: Pierce, 17.7 km. E, Crystal Creek Grade, *Christ* 14634 (Holotype: DS; Isotypes: NY, US). Photos: (RSA, UMO).

Plants sprawling caespitose, branching profusely from a slender woody base, in clumps 11-30 cm. in diameter; stems subdecumbent, 8-15 cm. long, strigose-sericeous with dense coarse ascending hairs, nodes 4-6; cauline petioles 2-4 cm. long; stipules 7-9 mm. long, connate to the petioles 3-4.5 mm., filiform; leaflets 5-7, elliptic-oblanceolate, apex acute to short mucronate, longest leaflets 2-18 mm., av. 10 mm. long, 0.8-5 mm. wide, length to width ratio 2.33-4.33, av. 3.18, strigose-pilose to villous on both surfaces, some more sparsely so on the upper surface to glabrous; peduncles 1.5-3.5 cm. long; racemes capitate, 2-3.5(6) cm. long, densely verticillate; flowers blue with yellow sulcus, 7-8.2 mm. long; bracts 5-9 mm. long, subulate-attenuate, sericeous to villous; pedicels 1.2-1.8 mm. long; calyx upper-lip 4.0-5.0 mm. long, bilobed, notch 2-3.5 mm. deep, lower-lip 5.0-6.0 mm. long, apex tridentate, center tooth 0.2-0.5 mm. long, lips connate 1.0-1.5 mm.; bracteoles 0.8-1.5 mm. long, attached at the sinus, villous; banner elliptic-oblanceolate, 7.0-8.0 mm. long, 4-4.5 mm. wide, length to width 1.56-1.88, av. 1.74, reflexed to appressed ratio 1.25-1.50, av. 1.37, angle 148-158°; wings 6.0-7.3 mm. long, 3.0-3.4 mm. wide, length to width ratio 1.97-2.35, av. 2.16; keel 2 mm. wide at the widest point, angle 111-122°, ciliated sparsely near the acumen; ovules 2-3; pods 8.5-9.5 mm. long, 3.4-4.0 mm. wide, densely short woolly; seeds 2-3, 1.8-2.0 mm. × 2.0-2.2 mm., 0.9-1.1 mm. thick, tan color.

Subspecies *alcis-temporis* is found in sandy and gravelly slopes on road cuts, generally in otherwise barren areas. One population occurs in a *Pinus monticola* forest; the Christ & Smith collection (15385 — NY) was found on "forest soil bordering beds of *Boykinia major;* the Daubenmire collection (47150 — WS) was made in a Spruce-Fir Zone. Plants occur at 915-1220 m. elevation.

Representative specimens: **Idaho:** CLEARWATER CO.: Pierce, 17.7 km E at the confluence of Big Breakfast Creek and Crystal Creek, *Christ & Smith* 15385 (NY); Washington and Lodge Creeks, S31, T39N, R7E, *Lingenfelter* 466 (NY, RSA, UC, WS).

This taxon was first described by C. P. Smith from a Christ "little number picked up in Clearwater County (Idaho) during elk season in October." Hence the name "Christ's Elk-Season Lupine", *Lupinus alcis-temporis* in Smith's Latinum utilizes the genitive for both elements of the compound name (*alces* — elk and *tempus* — season). Both Christ and Smith were deeply interested in the fact that a lupine in anthesis could be found in Clearwater Co. in the middle of October "without a trace of fruit or seed, and at only 4,000 feet elevation."

Several stages of development are found in more extensive study of other collections of these lupines, all of which have been collected on July 10th or July 11th. Small clusters of young herbaceous-stemmed, procumbent plants may be found flowering the same time as older plants with semi-woody branching stems, sprawling 30-45 cm. in diameter. The isotype material viewed from NY and US appears merely to be atypically late in reaching anthesis. It is in anthesis with some fruit in the initial stages of enlargement, and all branches are woody including secondary and tertiary branches; only the leaves and inflorescences remain herbaceous at this late seasonal date.

3. **Lupinus lyallii** subsp. **minutifolius** (Eastw.) B. J. Cox, comb. & stat. nov.

Lupinus minutifolius Eastw. Leafl. West. Bot. 2: 267. 1940. Holotype: OREGON: HARNEY CO.: Fish Lake, Steens Mts., *Henderson* 8132 (CAS). Photos: (RSA, UMO).

Plants acaulescent; foliage to 4.5 cm. tall; stems 4-6 cm. tall, appressed hispidulose with more coarse scaberose hairs; petioles filiform, 2.5-4 cm. long; leaflets 5-7, elliptical, glabrous above to sparse pubescence on the margins, short coarse appressed hairs below, largest 6-9 mm., av. 6.8 mm., 2-2.8 mm. wide, av. 2.45 mm., length to width ratio 2.4-3.0, av. 2.75; peduncles 6-8 cm. long or only 3 cm. long in immature plants; racemes 1.5-3.0 cm. long, 3-4 compact verticils, ascending or erect from nearly prostrate stems; flowers 7.5-10 mm. long, mostly blue with nearly white banners and purple tipped keels; bracts caducous, 4.5-6 mm. long, subulate; pedicels 1.0-2.0 mm. long; calyx upper lip 4-5 mm. long, bilobed, notched 2.5-2.7 mm. deep, lower-lip 4.5-5.0 mm. long, apex entire-serrate to tridentate with the center tooth approaching 0.7 mm. long, lips connate 1.2-1.3 mm., bracteoles 0.2 mm. long, attached at the sinus, strigose to short ascending pilose; banner elliptic-oblong, 8-8.5 mm. long, 4.2-5.5 mm. wide, length to width ratio 1.45-1.90, av. 1.65, reflexed to appressed ratio 1.08-1.57, av. 1.34, angle 150-160°; wings 8.8-9.0 mm. long, 3.8-4.2 mm. wide, length to width ratio 2.10-2.57, av. 2.34, claws 1.0-1.8 mm. long, glabrous; keel 2.0-2.2 mm. wide at the widest point, angle

118-123°, ciliated along the outer half of the upper margin, densest toward the acumen; ovules 3; pods 9.0-10.5 mm. long, 3.5-4.2 mm. wide, short appressed; seeds 2-4.

Subspecies *minutifolius* is found in the Steens Mountains of Harney Co., Oregon, geographically replacing subsp. *lyallii.* These plants are found on rocky, gravelly, gentle basaltic slopes but frequently occur in alpine meadows on hillside areas with grasses and sedges in sloping rocky habitats. Several specimens have been collected in beds of lingering snowbanks where snow has accumulated and remained during the winter and spring. Anthesis generally occurs during the latter part of July. Plants are found at elevations of 2439-2896 m.

Representative specimens: **Oregon:** HARNEY CO.: Big Fish Creek Canyon, *Maguire & Holmgren* 26789 (GH, NY, UC, US); Frenchglen, 31.4 km due E-SE, *Hansen* 490 (OSC).

Although some populations of subsp. *minutifolius* resemble subsp. *lyallii* var. *danaus*, they have several distinct morphological characteristics. The flowers of subsp. *minutifolius* generally have more oblong shaped banners, more linear wings, and therefore a greater length to width petal ratio than subsp. *lyallii.* Although the vegetative morphology of subsp. *minutifolius* resembles the alpine var. *danaus* and other northern forms of subsp. *lyallii*, it shows distinction in the filiform petioles from the basal clumps of less than 4.5 cm. tall, and frequently by the fewer (4-7, av. 5) leaflets that are glabrous on the upper surface. The plants of the Cronquist collection (8694 — NY, OSC, RM, RSA, UC, WS) are morphologically larger than normal for the taxon. The foliage of these specimens approach 5 cm. tall, overall plant height approaches 9.5 cm.; flowers are an intermediate 8.5 mm. long; the leaflets are larger 10 mm. × 3.5 mm.; peduncles are larger 6.5-7 mm. long, and racemes approach 4 cm. long.

4. **Lupinus lyallii** subsp. **subpandens** C. P. Sm. ex Dunn, El Aliso **3**: 171. 1955. Type: NEVADA: ELKO CO.: Elko,

113 km. NW, *Holmgren,* Jun 1938 (Holotype: UTC; Isotypes: NA, NEV, AGR.). Photos: (RSA, UMO).

Plants with many small tufts from a profusely branching woody caudex, erect; foliage 4.5-9.0 cm. in height, mostly less than 6 cm. tall; stems 7-18 cm. tall, usually less than 1 mm. in diameter, appressed strigose-pilose pubescence less than 2 mm. long; leaves in basal clusters; petioles slender, 3-9 cm. long; stipules inconspicuous, 6-10 mm. long, connate to the petioles 4-5 mm. subulate; leaflets 5-6, linear-oblanceolate, apex acute, largest 9-22 mm. long, 2-5 mm. wide, length to width ratio 3.5-6.3, av. 4.8, sericeous-strigose below, more sparsely so above with glabrous apex and midrib; peduncle 5-9 cm. long, usually exceeding the foliage by 2-5 cm.; racemes capitate to subcapitate, 1.5-4 cm. long; flowers dense, blue, 9.5-11.5 mm. long; bracts 4-8.5 mm. long, appressed to ascending pilose; pedicels 1-2 mm. long; calyx upper-lip 4.2-5.5 mm. long, notch 1.3-3.2 mm. deep, lower-lip 4.5-5.5 mm. long, apex deeply serrate to tridentate, center tooth to 0.5 mm. long, lips connate 1.0-1.5 mm., bracteoles slender, inconspicuous, 0.5-1.0 mm. long, attached to the sinus, strigose-sericeous, hairs to 2 mm. long; banner elliptic, 8-9.5 mm. long, 5-6.5 mm. wide, length to width ratio 1.45-1.90, av. 1.56, reflexed to appressed ratio 1.13-1.71, av. 1.44, angle 146-150°; wings 8.2-9.8 mm. long, 3.4-4.8 mm. wide, length to width ratio 2.04-2.65, av. 2.36, claws 1.5-2.0 mm. long, glabrous; keel 2.2-3.0 mm. wide at the widest point, angle 108-120°, ciliated along the outer half of the upper margin, most densely near the acumen, cilia to 0.7 mm. long; ovules 3-5; pods 11-14 mm. long, 5-5.5 mm. wide, dense strigose to short villous; seeds 2-3, 2.0-2.2 mm. × 2.8-3.0 mm. 1.3 ± 0.1 mm. in thickness, beige to tan with darker brown mottling.

These plants are found in dry, rocky creek beds and open well-drained draws in northeastern Nevada, in Elko Co., and southwestern Idaho, in Camas and Owyhee Counties. The most common associate is *Artemisia* sp. Plants flower from mid-July to the first part of August. Altitudinally, they are found at 1677-1982 m., with one population found on Alleghany Creek at 2439 m.

Representative specimens: **Idaho:** CAMAS CO.: Fairfield, 16 km. SE, *Ripley & Barneby* 10671 (NY). OWYHEE CO.: Mud Flat, 4.8 km. SW, on road to Juniper Mt, *Maguire & Holmgren* 26305 (GH, POM, UC, US, UTC, WS). **Nevada:** ELKO CO.: O'Neil, 16 km. S, *Holmgren, Cooper & Cain* 181 (GH, OSC, UTC); Wells, 48 km. N, *Jones*, Jul 1901 (POM).

Dunn (1955) interpreted *Lupinus lyallii* subsp. *subpandens* as an acquisition of a combination of the characters of *L. aridus* with those of *L. lyallii.* The pubescence type and system of branching from the caudex, as well as certain flower morphology, is characteristic of *L. aridus,* whereas the small caespitose habit with elongated peduncles and capitate inflorescences with small flowers is more indicative of *L. lyallii.* Dunn further suggests that the plant's occupancy of the flatland *Artemisia* habitat of 1677-1982 m. elevation indicates a considerable amount of the *L. aridus* physiological adaptations, contrasting the higher altitudinal *L. lyallii* habitat.

This study concurs with Dunn's interpretation of the affinity of subsp. *subpandens* with *L. lyallii.* These plants inhabit a geographically distinct region, also having both morphological and physiological distinction. Although each subsp. *subpandens* population has acquired a unique combination of characteristics, the plants can usually be recognized by the erect habit of both flowering culms and petioles as well as by the glabrous apex and midrib of the upper leaflet surfaces.

The specimens from Camas Co., Idaho (*Ripley & Barneby* 10671 — NY) have larger flowers than the taxon mean, with banners only slightly reflexed and frequently with one node on the flowering culm above 2 cm. from the basal cluster of leaves, and racemes of 3-5 cm. long, being about 2 cm. in diameter.

The specimens collected south of O'Neil, Nevada (*Holmgren, Cooper & Cain* 181 — GH, OSC, UTC) are more slight in habit, having shorter petioles with smaller leaflets that are more glabrous on the upper surface, and shorter, more capitate racemes with the banners less reflexed.

The Mud Flat, Owyhee Co., Idaho specimens (*Maguire & Holmgren* 26305 — GH, POM, UC, US, UTC, WS) have fewer leaflets than other populations, and the petioles are more elongated and slender.

5. **Lupinus lyallii** subsp. **washoensis** (Heller) B. J. Cox, comb & stat. nov.

L. washoensis Heller, Muhlenbergia **6**: 72. 1910. based on *L. pinetorum* Heller, Muhlenbergia **6**: 25. 1910, not *L. pinetorum* Jones, Contr. West. Bot. **8**: 25. 1898. Type: NEVADA: WASHOE CO.: Ridge S of Alum Creek, *Heller* 9748 (Holotype: Nev. Agr.; Isotypes: DS, GH, ISC, MO, NY, ORE, POM, UC, US, WS). Photos: (RSA, UMO).

L. aridus var. *washoensis* (Heller) C. P. Sm., Bull. Torrey Bot. Club **51**: 303. 1924.

Plants 10-18 cm. tall, in dense caespitose clumps, 15-30 cm. in diameter, from woody vertical caudex branching at ground level, with 10-18 racemes flowering simultaneously; stems procumbent to erect, 1-2.5 mm. in diameter, villous to hirsute-shaggy white pubescence 2-4 mm. long; 2-3 nodes; cauline petioles 4.5-8 cm. long, pubescence as on the stems; basal petioles on immature plants 4.5-7 cm. long; stipules 6-10 mm. long, connate to petioles 4-6 mm., densely white bearded pubescence; leaflets 5-6, oblanceolate to elliptic-oblong, apex short mucronate, largest 9-21 mm. long, av. 13.7 mm., 3-7 mm. wide, length to width ration 1.86-3.27, av. 2.71, silvery appressed to ascending pubescence below, more sparsely so above, upper surface appearing more greenish; peduncles 3-5 cm. long, generally exceeding the leaves; racemes 3-6 cm. long, 1.6-1.9 cm. in diameter, densely subverticillate; flowers blue to violet, banner with a white sulcus, 8-9 mm. long; bracts 3-5.5 mm. long, subulate-attenuate, pilose-sericeous; pedicels 1.5-2.0 mm. long; calyx upper-lip 3.5-4.5 mm. long, bilobed, the notch 0.8-1.2 mm. deep, lower-lip 4-5.5 mm. long, apex serrate, lips connate 1-2 mm., bracteoles 0.5-1.0 mm. long, attached at the sinus, villous; banner elliptic-oblong, 7.8-8.0 mm. long, 5.0-6.0 mm. wide, length to width ratio 1.33-1.67, av. 1.52, reflexed to appressed ratio 1.25-1.35, angle 140-150°; wings 7.5-8.0 mm. long, 4-4.5 mm. wide, length to width ratio 1.74-2.00, av. 1.87, claws 1.5-2.0, glabrous; keel 2.5-3.0 mm. wide at the widest point, angle 118-125°, ciliated along the upper margin near the acumen; ovules 2-3; pods 9-13 mm. long, 5-6 mm. wide, villous to ascending woolly; seeds 1-3, 1.8-2.2 mm. × 2.4-2.7 mm., 0.9-1.2 mm. thick, tan with brown mottling.

Subspecies *washoensis* has a restricted habitat on the eastern slopes of the Sierra Nevada in the southern part of Washoe Co., SW of Reno, Nevada. Plants occur on gravelly montane open pine slopes at elevations of 1524-2134 m., flowering in June.

Representative specimens: **Nevada:** WASHOE CO.: Dinsmore Camp, Hunter Creek Canyon, *Kennedy* 1614 (MO, NY, UC); Reno, *Hillman* (POM); 10-13 km. SW, Hunter's Creek Road, *Archer* 6090 (NY).

The general appearance of some of these plants indicates relationship with *Lupinus aridus*, a portion of the racemes being exceeded in height by the foliage. Affinity is also indicated with *L. sellulus* var. *lobbii* in general morphological structure (Cox 1972a, 1973c). Considering the total conformation — narrow, short subcapitate or longer racemes, and the procumbent, branching, sprawling vegetative habit — this study concludes that the *washoensis* affinity lies most closely with *L. lyallii*. These plants replace *L. lyallii* subsp. *lyallii* geographically and ecologically, aso being recognizably distinct by somewhat larger stature, having longer racemes, larger leaves, more yellow-green color and spreading silvery stem and petiole pubescence.

The Dinsmore population (*Kennedy* 1614 — MO, NY, UC), which is only a few miles north of the type locality in Hunter Creek Canyon, has been used in sheep feeding experiment (Nev. Agr. Exp. Sta. Bull. 71: 30. 1909). The plants are said to be relished by the sheep, proving to be a good forage plant.

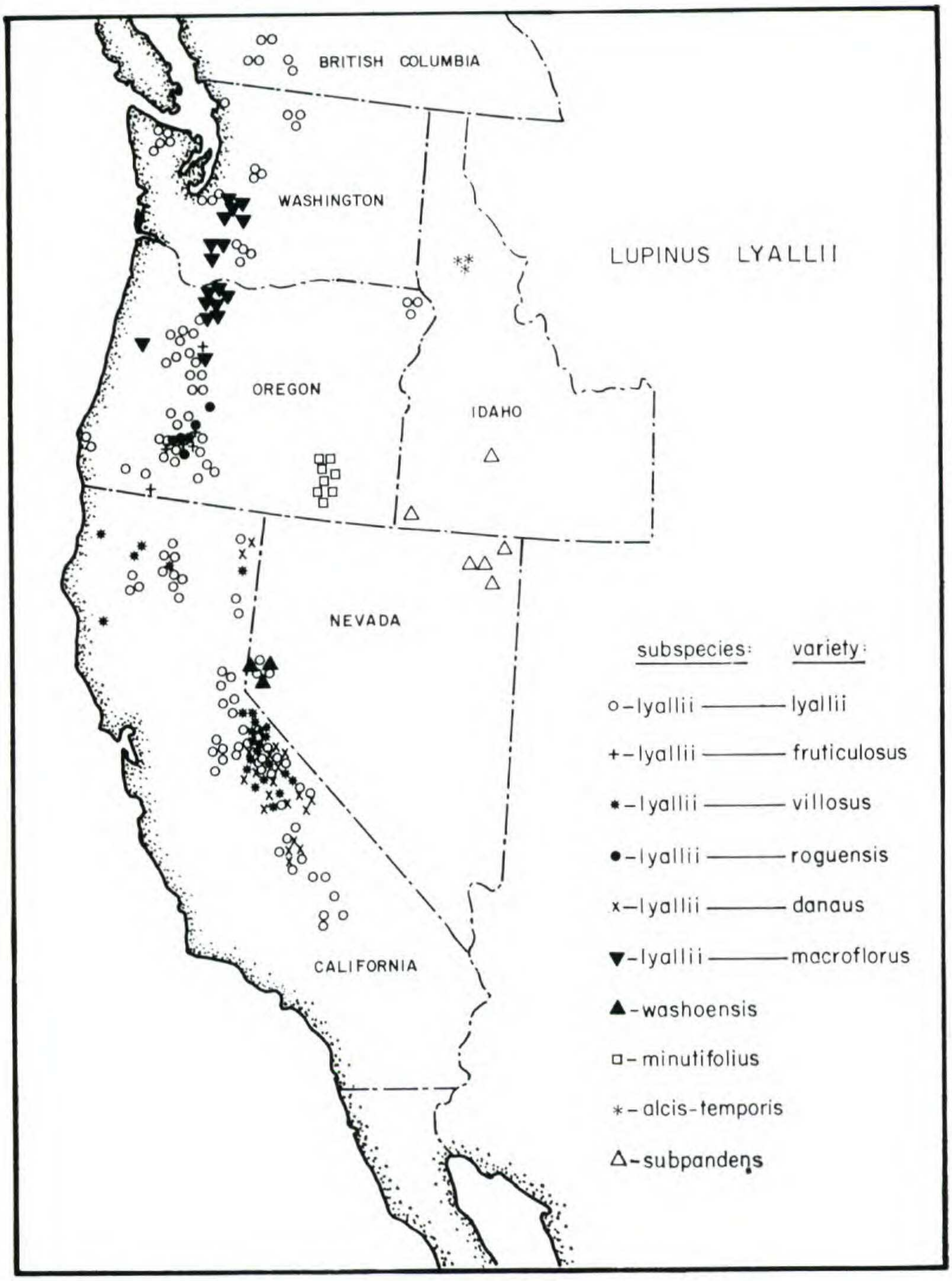

Figure 1. Distribution of *Lupinus lyallii.*

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